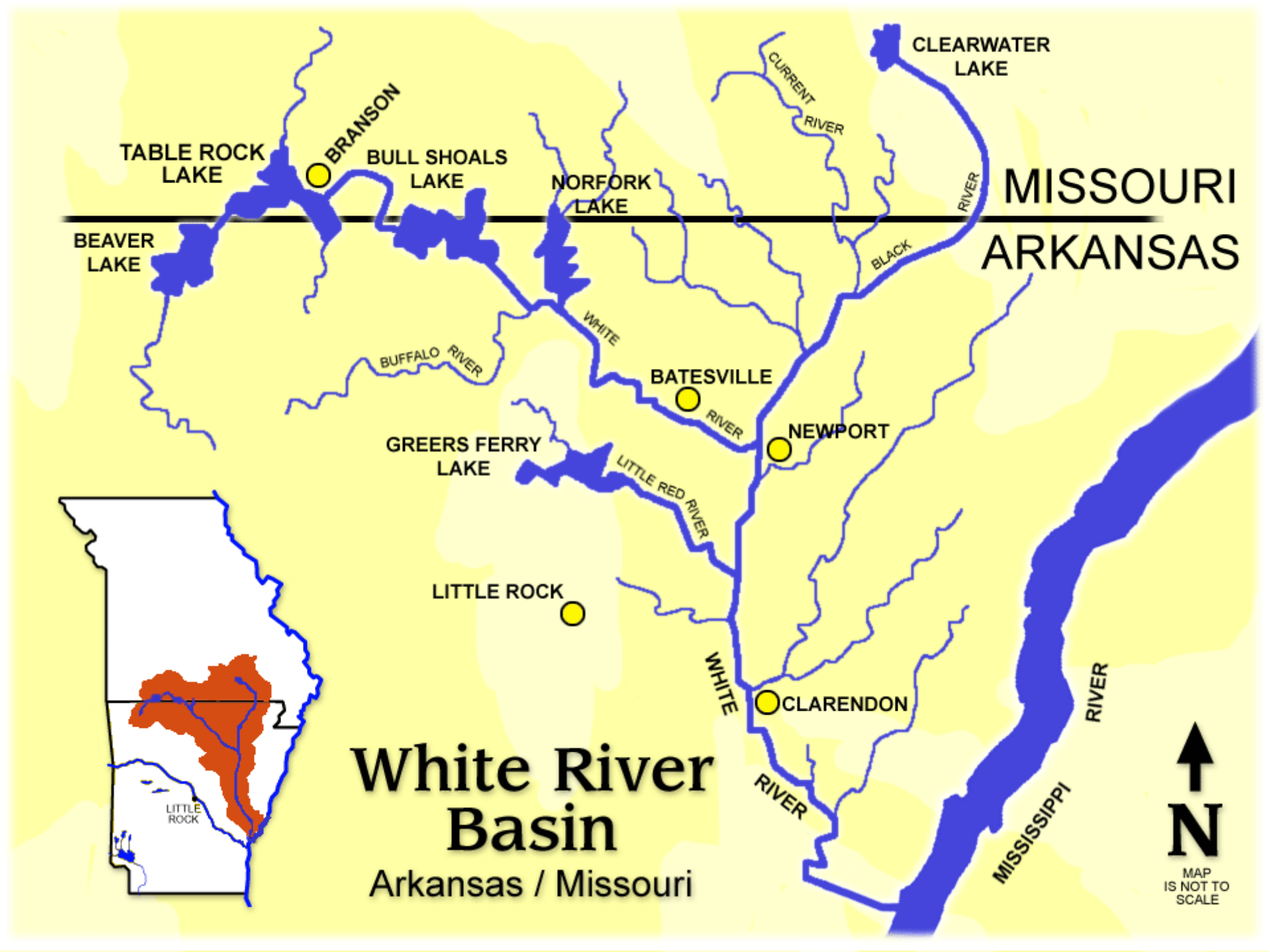
US Army Corps
of Engineers ®

Computing Dependable Yield Mitigation Storage -DYMS-

One Corps Serving The Army and the Nation


CLEARWATER LAKE
CURRENT RIVER
TABLE ROCK LAKE
BRANSON
BULL SHOALS LAKE
NORFORK LAKE
RIVER
MISSOURI
ARKANSAS
BEAVER LAKE
BLACK
WHITE
BUFFALO RIVER
BATESVILLE
RIVER
NEWPORT
GREERS FERRY LAKE
LITTLE RED RIVER
LITTLE ROCK
WHITE
CLARENDON
RIVER
MISSISSIPPI
RIVER
LITTLE ROCK
White River Basin
Arkansas / Missouri
N
MAP IS NOT TO SCALE

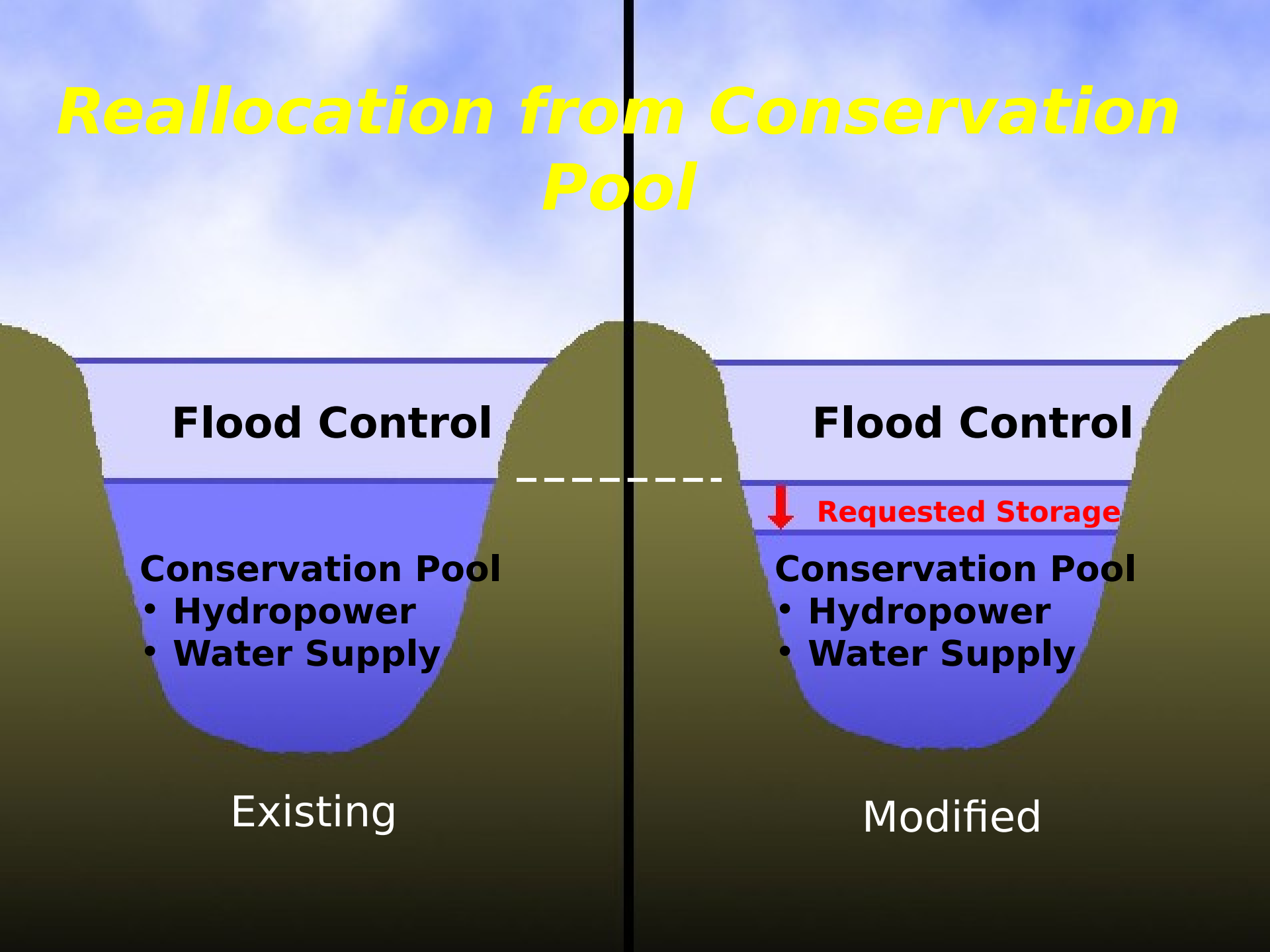
US Army Corps of Engineers®

Why Compute DYMS?

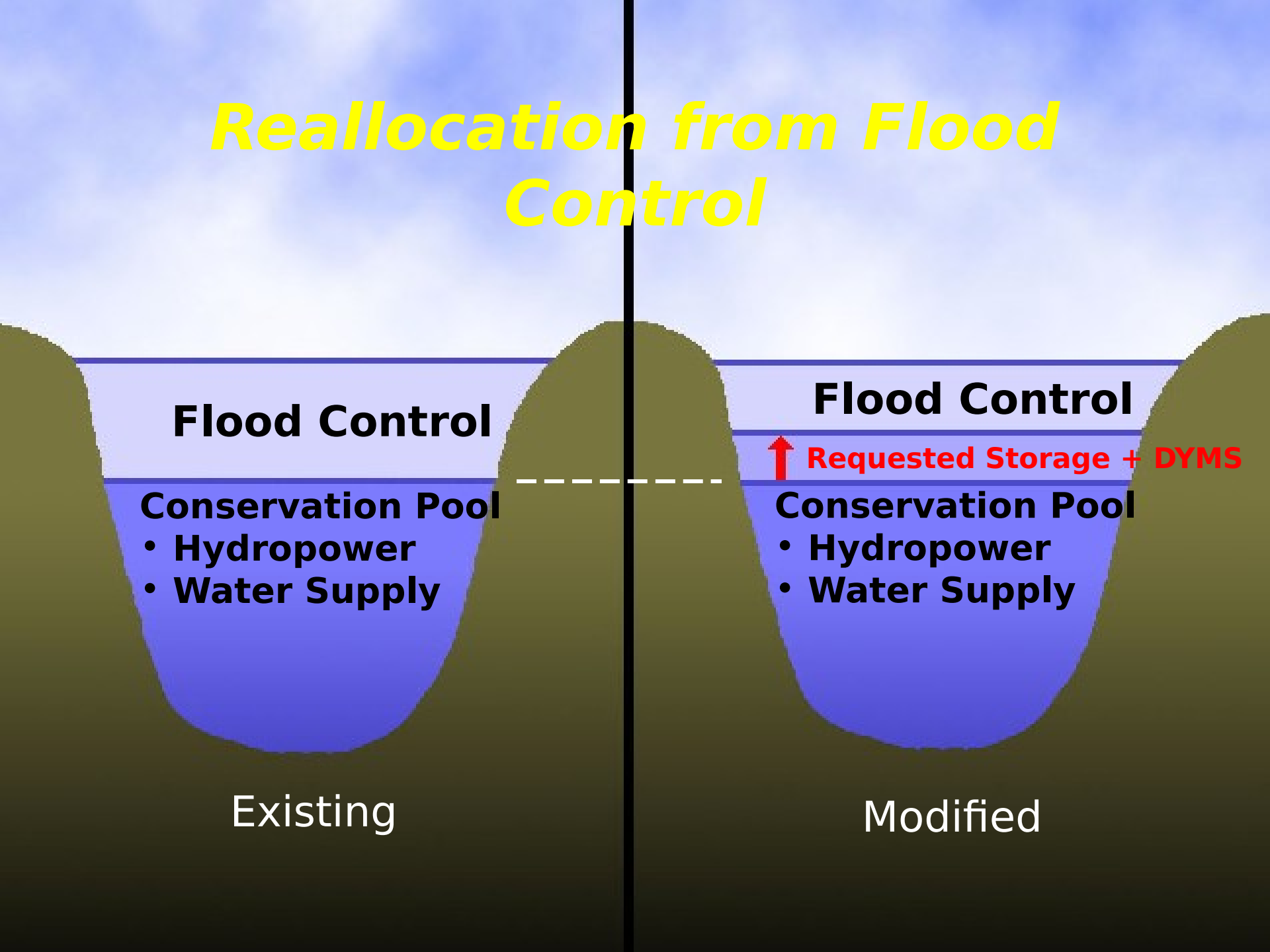
DYMS:

- Are determined to keep other water supply users yield whole
- Require requesting entity to purchase the extra storage to keep other users yield whole
- Must be calculated when storage is reallocated from the flood pool
- Do not have to be calculated when reallocations are made from the conservation pool

Reallocation from Conservation Pool

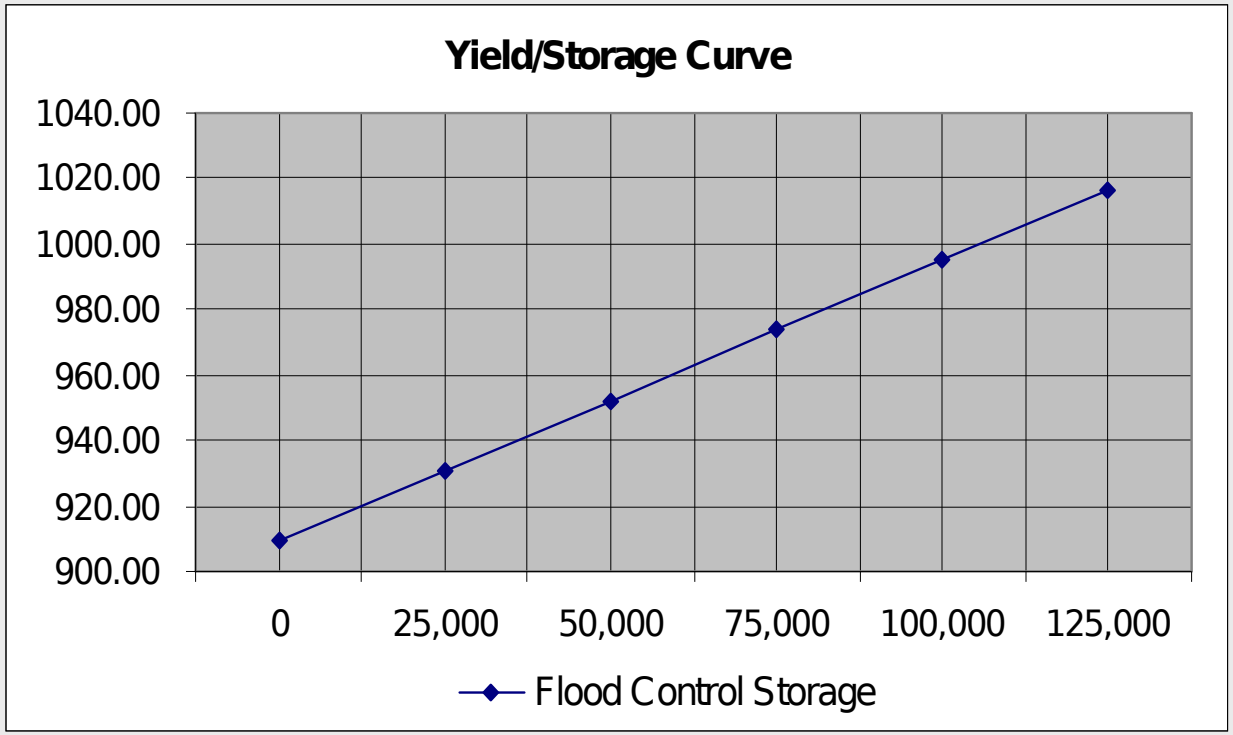


Reallocation from Flood Control



US Army Corps
of Engineers ®

Computing DYMS



YIELD/STORAGE TABLE FOR REALLOCATION OF 50,000 AF				
Change in Storage	Top of Conservation (Flood Pool)			Conservation Pool Storage
	Elev.	Yield		
(AF)		(mgd)	(cfs)	(AF)
0	461.00	587.631	909.20	716,500
25,000	461.79	601.398	930.50	741,500
50,000	462.58	615.294	952.00	766,500
75,000	463.36	629.513	974.00	816,500
100,000	464.14	643.279	995.30	866,500
125,000	464.91	656.787	1016.20	941,500

NOTES: This table was generated using the SUPER model.
The following base parameters were used:
Reservoir leakage is 35 cfs
Drawdown dates: 25,000AF - 13MAY53 - 28DEC54
50,000AF - 13MAY53 - 28DEC54
Date of refill: 04APR57

USERS	CURRENT	FUTURE			Upper Limit
		CONS	FLOOD		
	mgd	mgd		AF	mgd
City of Clinton - requested that their yield be raised to 2.5 mgd. That's an increase of 1.8 mgd.		1.76187	1.762	Unknown	1.762
City of Heber Springs	0.07320	0.07320	0.073	Unknown	0.073
Tannunbaum/Silver Ridge Development	2.87330	2.87330	2.873	Unknown	2.873
Thunderbird Country Club	0.04464	0.04464	0.045	Unknown	0.045
Community Water System, Inc. (Lonoke/White)	3.50000	3.50000	3.500	Unknown	3.500
Red Apple Inn & Country Club	0.05310	0.05310	0.053	Unknown	0.053
Community Water System, Inc. (Cleburne/Faulkner)	3.08700	3.08700	3.087	Unknown	3.087
Community Water System, Inc.	0.18460	0.18460	0.185	Unknown	0.185
City of Clinton	0.73813	0.73813	0.738	Unknown	0.738
City of Heber Springs	0.83500	0.83500	0.835	Unknown	0.835
Hydropower	582.75008	580.98820	Unknown	714,356.800	582.750
TOTAL - mgd	594.139	594.139	Unknown	Unknown	595.901
TOTAL - AF	728,317.821	728,317.821	Unknown	Unknown	Unknown
Ratio - (TOTAL - mgd) / (TOTAL - AF)	0.000815769	0.000815769	Unknown	Unknown	Unknown

Know that the coordinate for the FUTURE "FLOOD" TOTALS (mgd & AF) lie on the yield curve

Know that the new coordinate is above the CURRENT coordinate of:	594.139	728,317.821
Know that the new "X_2" coordinate is less than: (because we know that hydropower yield is not kept constant)	595.901	

Guess at a yield value that is:	<	595.901
	>	594.139

Solve for "Y_2":	X_1, Y_1	X_2, Y_2	X_3, Y_3
	587.631	**595.337**	601.398
	716,500.000	**730,493.198**	741,500.000

Determine your new yield/storage ratio: 0.000814979

Solve for the remaining "unknowns".

	FLOOD	
	mgd	AF
City of Clinton	1.762	Unknown
City of Heber Springs	0.073	Unknown
Tannunbaum/Silver Ridge Development	2.873	Unknown
Thunderbird Country Club	0.045	Unknown
Community Water System, Inc. (Lonoke/White)	3.500	Unknown
Red Apple Inn & Country Club	0.053	Unknown
Community Water System, Inc. (Cleburne/Faulkner)	3.087	Unknown
Community Water System, Inc.	0.185	Unknown
City of Clinton	0.738	Unknown
City of Heber Springs	0.835	Unknown
Hydropower	Unknown	714,356.800
TOTAL	595.337	730,493.198
Ratio	0.000814979	

City of Clinton	1.762	/ 0.000814979	=	2,161.862
City of Heber Springs	0.073	/ 0.000814979	=	89.818
Tannunbaum/Silver Ridge Development	2.873	/ 0.000814979	=	3,525.610
Thunderbird Country Club	0.045	/ 0.000814979	=	54.774
Community Water System, Inc. (Lonoke/White)	3.500	/ 0.000814979	=	4,294.587
Red Apple Inn & Country Club	0.053	/ 0.000814979	=	65.155
Community Water System, Inc. (Cleburne/Faulkner)	3.087	/ 0.000814979	=	3,787.826
Community Water System, Inc.	0.185	/ 0.000814979	=	226.509
City of Clinton	0.738	/ 0.000814979	=	905.700
City of Heber Springs	0.835	/ 0.000814979	=	1,024.566

	mgd
City of Clinton	1.762
City of Heber Springs	0.073
Tannunbaum/Silver Ridge Development	2.873
Thunderbird Country Club	0.045
Community Water System, Inc. (Lonoke/White)	3.500
Red Apple Inn & Country Club	0.053
Community Water System, Inc. (Cleburne/Faulkner)	3.087
Community Water System, Inc.	0.185
City of Clinton	0.738
City of Heber Springs	0.835
Total	13.151

595.337 – 13.151 = 582.186

	FUTURE FLOOD	
	mgd	AF
City of Clinton	1.762	2,161.862
City of Heber Springs	0.073	89.818
Tannunbaum/Silver Ridge Development	2.873	3,525.610
Thunderbird Country Club	0.045	54.774
Community Water System, Inc. (Lonoke/White)	3.500	4,294.587
Red Apple Inn & Country Club	0.053	65.155
Community Water System, Inc. (Cleburne/Faulkner)	3.087	3,787.826
Community Water System, Inc.	0.185	226.509
City of Clinton	0.738	905.700
City of Heber Springs	0.835	1,024.566
Hydropower	582.186	714,356.791
TOTAL	595.337	730,493.198

Check calculated HP storage against current HP:	714,356.791	
	714,356.800	
	-0.00939042	<= Should approach zero

Keep guessing untill remainder approaches zero.

US Army Corps of Engineers ®

Summary

1. Iterative Process
2. Obtain Yield/Storage Curve and Curve Data
3. Guess at a new Total Yield (Current Reallocation < GUESS < Upper limit)
4. Interpolate to obtain New Storage
5. Determine new Yield/Storage Ratio
6. Use new Yield/Storage Ratio to obtain new storage values
7. Subtract the sum of the yield values from your "GUESSED Yield" to obtain Hydropower Yield
8. Check calculated hydropower storage against current hydropower storage
9. Re-iterate until the difference approaches zero

US Army Corps of Engineers ®

For further information contact:

Jonathan C. Long, P.E.

(501) 324-7342

CESWL-PR-P

Jonathan.c.long@usace.army.mil

Questions?